Driver education and teen crashes and traffic violations in the first two years of driving in a graduated licensing system

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Abstract

Our primary research question was whether teens obtaining their level two Provisional Operators Permit (POP) in a Graduated Driver Licensing (GDL) environment through driver education differed in crashes and traffic violations from teens who obtained their POP by completing a certification log without taking driver education. A descriptive epidemiological study examining a census of all teen drivers in Nebraska (151,880 teens, 48.6% girls, 51.4% boys) during an eight year period from 2003 – 2010 was conducted. The driver education cohort had significantly fewer crashes, injury or fatal crashes, violations, and alcohol-related violations than the certification log cohort in both years one and two of driving following receipt of the POP. Hierarchical logistic regression was conducted, controlling for gender, race/ethnicity, median household income, and residence. In both year one and two of driving, teens in the certification log cohort had higher odds of a crash, injury or fatal crash, violation, or alcohol-related violation. Findings support that relative to a supervised driving certification log approach, teens taking driver education are less likely to be involved in crashes or to receive a traffic violation during their first two years of driving in an intermediate stage in a graduated driver licensing system. Because teen crash and fatality rates are highest at ages 16 and 17, these reductions are especially meaningful. Driver education appears to make a difference in teen traffic outcomes at a time when risk is highest.

Keywords:

Driver education
Crash
Graduated driver licensing
Injury outcome
Traffic violations

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1. INTRODUCTION

Driver Education programs for teen drivers are designed to prepare beginning drivers for license testing and licensing (Thomas et al., 2012). Driver education courses typically combine both classroom instruction on topics such as vehicle safety, laws and regulations, vehicle operation, and factors affecting driving (alcohol, road conditions, distraction, etc.) and behind-the-wheel driving practice with a trained instructor. Most examinations of driver education have focused on crashes (Lonero & Mayhew, 2010). This makes sense as crashes, especially fatal crashes, are the most significant and important negative outcome for teen drivers. Traffic violations, however, represent another type of important negative outcome. Whether due to inexperience or deliberate decision, most risky driving such as speeding, driving too close, texting, or recklessness is also driving that is in violation of driving statutes. Higher instances of violations have been found to be associated with teen fatal crashes (Gonzales et al., 2005).

Prior evaluations are mixed on whether driver education produces benefits in terms of fewer crashes and traffic violations. The most comprehensive prospective study of driver education was the DeKalb project (Smith, 1983; Smith & Blatt, 1987; Lund et al., 1986). Crashes per licensed driver were lower in the comprehensive driver education group in the first six months, but reductions in crashes per licensed driver were off-set by earlier licensing. No effects were found for violations. Subsequent long-term analyses up to six years have found conflicting evidence for and against benefits for driver education groups (Smith & Blatt 1987; Lund et al., 1986). Findings have generated considerable controversy about both the utility of the randomized trial, confounding of the control group, and debate about the quality and appropriateness of various statistical analyses applied (Mayhew et al., 1998; Peck, 2011).

Following the DeKalb project, controlled trial studies in Australia (Strang et al. 1982; Wynne-Jones & Hurst 1984) and Sweden (Gregersen, 1994) produced mixed but mostly non-significant results on crashes. A number of quasi-experimental studies have been conducted (Lonero et al. 2005; Maycock 1995; McKenna et al. 2000). As with controlled trial studies, there have been mixed results with the majority of studies showing no significant effects on crashes or violations, some studies showing reductions in crashes for those taking drivers education, and some studies showing an increase in crashes for drivers education. A problem with all these studies has been reliance on self-report surveys, either alone or in conjunction with analysis of driver records, resulting in confounds from small samples to poor response rate (Beanland et al., 2013; Lonero & Mayhew 2010; Peck, 2011). Finally, Levy (1990) used econometric modeling to examine factors influencing fatal crash rates in 47 states. He concluded that a mandatory driver education requirement had a small but significant association with fewer fatalities in 15-17 year olds. Recent comprehensive reviews of these studies can be found in Lonero and Mayhew (2010), Peck (2011), and Thomas et al. (2012).

1.1. Graduated Driver Licensing

Traffic safety efforts for teen drivers changed in the 1990's to an emphasis on graduated driver licensing (GDL). Unlike the mixed results for driver education, Baker et al. (2007) in a comprehensive review, found that GDL has reduced the incidents of fatal traffic crashes in the 15-17 year old age groups. The potential role of driver education in the GDL environment, however, is poorly understood. Most formal studies of driver education occurred before wide-spread adoption of GDL in the 1990's and 2000's. Recent studies suggest that driver education may produce positive effects in the GDL environment. Zhao et al. (2006) examining drivers in Ontario Canada's learner stage, found that driver education graduates reported fewer crashes and driver education was the only factor significantly associated with lower crash rate. Vanlaar, et al.

(2009) in a study of 46 states and 11 Canadian Provinces, found that mandatory driver education as a condition of the learner stage of GDL resulted in a 34.5% reduction in relative fatality risk for 18 year olds, but no reduction for 16 or 19 year olds. Although these recent studies suggest positive impacts of driver education within the GDL framework, there have been few systematic studies of driver education since wide-spread adoption of GDL (Mayhew, 2007; Thomas et al., 2012).

1.2. The Present Study

The objective of this study was to examine whether teens taking driver education differed in crashes and moving traffic violations from teens not taking driver education within a Graduated Driver Licensing (GDL) environment. We conducted a descriptive epidemiological study examining a census of all teen drivers in Nebraska during an eight year period from 2003 - 2010. To apply for the intermediate level Provisional Operators Permit (POP) in the Graduated Driver Licensing (GDL) system in Nebraska, teens must complete *either* (1) a 50 hour supervised driving certification log or (2) a certified driver education course. All other aspects of the GDL process are the same for both groups. This allows comparison of subsequent traffic violations between the cohort of age 16 teens who completed driver education and the cohort of teens who completed the certification log but not driver education without confounds from different licensing procedures such as time discounting. The first two years of driving have been found to be a critical period for teen crashes, linked to levels of inexperience (Foss et al., 2011). Because of the unique risk in these years, the first two years of driving at ages 16 and 17 were examined.

Nebraska has a modified three-stage GDL system. At age 16, a teen can apply for the intermediate stage Provisional Operators Permit (POP) that is the focus of this study. The POP allows a teen to operate a motor vehicle unsupervised from 6 a.m. - 12 midnight, from 12

midnight and 6 a.m. if they are driving to or from home to work or a school activity, and anytime if accompanied by a parent or licensed driver age 21 or older. During the first six months of the POP, drivers are restricted to no more than one passenger under age 19 who is not an immediate family member. The POP is preceded by either a learner permit obtained at age 15 or a school permit which can be obtained as early as age 14.

As prescribed by the Nebraska Department of Motor Vehicles a certified driver education course must contain a minimum of 20 hours of classroom instruction and five (5) hours of behind-the-wheel instruction (2 hours for competency based courses taught by competency certified instructors). Nebraska's prescribed driver education curriculum meets some but not all of the guidelines in the standards developed by the National Highway Traffic Safety Administration (NHTSA, 2012).

Our primary research question was whether there was a difference in occurrence of traffic crashes and moving violations between the cohort of teens who obtained their Provisional Operators Permit (POP) through driver education and the cohort of teens who obtained their POP by completing the certification log.

2. METHOD

2.1. Study Population

The study population was a census of all 151,880 Nebraska teens (89.1% White non-Hispanic, 3.1% African-American, 1.9% Hispanic, 1.6% Asian, .6% Native American, 3.7% other) who received their Provisional Operator's Permit (POP) between January 1, 2003 and December 31, 2010. There were 73,786 (48.6%) girls and 78,084 (51.4%) boys. Urban areas were defined as the three counties containing the state's two cities of over 240,000 population along with their contiguous metropolitan areas. These urban areas contain approximately 48% of

the state population. In the study population, 70,891 (46.7%) were from urban areas and 80,989 (53.3%) were from rural areas matching the general state population demographics.

For analysis of year two crashes, a subset of the study population consisting of those who received their POP between January 1, 2003 and December 31, 2009 was used. This sample consisted of 132,133 Nebraska teens (89.4% White non-Hispanic, 3.0% African-American, 1.3% Hispanic, 1.6% Asian, .6% Native American, 4.0% other). There were 64,128 (48.5%) girls and 68,005 (51.5%) boys with 61,605 (46.6%) from urban areas and 70,528 (53.4%) from rural areas.

The census included all teens obtaining a POP during the study period, with the exception of 154 teens for whom POP documentation records were incomplete. Teens who moved out-of-state, as indicated by traffic records license surrender data, also were removed unless they had an accident or a citation prior to surrender. This resulted in the removal of 707 teens from the year one analyses and 1,675 teens from the year two analysis.

Data on school permit holders was not available prior to 2007. Within the approximately half of the study population with school permit (SCP) data, 12.7% of the year 1 population and 15.4% of the year 2 sub-population held a SCP. SCP permit holders did not differ from non-SCP permit holders in whether they obtained their POP through driver education or certification log in either the year 1 or year 2 populations. Because of the lack of SCP data prior to 2007, SCP cannot be statistically controlled in analyses. But, the equivalence of SCP holders in the driver education and certification log cohorts reduces the possibility of bias due to the SCP as any impacts of SCP should be consistent across both cohorts.

2.2. Data Sources

Driver information data including demographics and Provisional Operator Permit licensing data and citations for traffic violations were obtained from Nebraska Traffic Records Data

maintained by the Nebraska Department of Road and Nebraska Office of Highway Safety. Traffic Records Data contains the record of all traffic violations in the state of Nebraska that have resulted in a conviction. The data does not contain any records of citations that have been excused because of pre-trial diversion programs. Citation issuance date was used for analysis regardless of when the actual conviction occurred. Only moving violations and secondary violations reflecting risky behaviors (e.g., no seatbelt) were used.

Crash data was obtained from the Crash Outcome Data Evaluation System (CODES) maintained by the Nebraska Department of Health and Human Services. CODES is a collaboration between the Nebraska Department of Health and Human Services and the National Highway Traffic Safety Administration (NHTSA). Unlike the Fatal Accident Reporting System (FARS), CODES contains information on all crashes not just fatal crashes. Data were retrieved from Nebraska Traffic Records Data and CODES in 2008, 2011, and 2012 containing records for all teens receiving a POP from the years 2003 to 2010 inclusive. Final data cleaning and verification was done in summer 2012.

Having a crash or violation within the first year after receiving the POP was computed by adding one year to the date that the POP was issued and then determining whether a crash or violation occurred within that one year period based on the crash date from CODES or the citation issuance date from Traffic Records Data. Having a crash within the second year after receiving the POP was computed by adding two years to the date that the POP was issued and then determining whether a crash or violation occurred between the one year and two year dates. Having an injury or fatal crash was determined by a CODES accident severity code of 1 (fatal), 2 (disabling injury), or 3 (visible injury). Having a DUI violation was determined by a violation code of any DUI violation.

Household income was estimated from U.S. Census five-year median household income (12 months, inflation-adjusted) from the American Community Survey (ACS) estimates for 2005-2009. Median household income was determined in two ways. In the seven Nebraska counties that had more census tracts than Zip codes, census tract information within the county was used. Permanent address from licensing records was geocoded to census tracts utilizing TomTom's Teleatlas software (www.geocode.com). Geocodes were used to obtain ACS median household income for the 85,210 teens in these counties from the U.S. Census' website, FactFinder2. For remaining 86 counties, census tract was assigned to zip code using the University of Michigan's census tract to zip code cross-walk (http://www.psc.isr.umich.edu/dis/census/features/tract2zip/methods.html). ACS median household income by tract then was obtained from the U.S. Census' website FactFinder2 and proportionately allocated within Zip Code based on the tract proportion within Zip area.

2.3. Analysis

All analyses were run on SPSS versions 20 and 21. To control for potential confounds due to gender, ethnic, residence, and income differences between teens in the driver education and certification log cohorts, hierarchical logistic regression was conducted. In the first step, dummy coded gender, ethnicity (White non-Hispanic vs other racial/ethnic groups), and urban vs rural residence and *z*-score transformed ACS median household income were entered as a control block. In the second step, dummy coded POP cohort (driver education vs certification log) was entered. Significance for POP cohort was determined by change in χ^2 at step 2.

3. RESULTS

3.1. Demographics

In the study population, 80,685 (53.1%) teens were in the driver education cohort and 71,195 (46.9%) were in the certification log cohort. Teens in the driver education cohort were

significantly more likely to be girls (54.6% to 51.7% boys), be of White non-Hispanic ethnicity (56.0% to 29.4% non-White), have higher median household income ($60,344 to $52,561), and reside in an urban area (57.9% to 48.9%).

3.2. Crashes and Violations in the POP First Year

In year one of driving following the POP, 18,097 teens (11.9%) had a crash and 3,568 teens (2.3%) had an injury or fatal crash. The driver education cohort had significantly fewer crashes (8,395; 11.1%) than the certification log cohort (9,162; 12.9%), χ^2 (1) = 116.10, $p < .0001$ and significantly fewer injury or fatal crashes (1,717; 2.1%) than the certification log cohort (1,851; 2.6%), χ^2 (1) = 36.71, $p < .0001$. For violations, 21,458 teens (14.1%) had a violation and 160 (0.1%) had a DUI violation. The driver education cohort had significantly fewer violations (8,395; 10.4%) than the certification log cohort (13,063; 18.3%), χ^2 (1) = 1967.12, $p < .0001$ and significantly fewer alcohol related violations (46; 0.1%) than the certification log cohort (114; 0.2%), χ^2 (1) = 38.21, $p < .0001$.

POP cohort accounted for significant increase in prediction for crashes and injury/fatal crashes during the first year of driving following the POP (Table 1). Relative to other predictors, teens in the certification log cohort had the second highest odds of a crash (1.21) and highest odds of an injury/fatal crash (1.25). Teens of living in urban areas and in households with lower median income had higher odds of being in a crash or an injury/fatal crash and teens of White non-Hispanic ethnicity had higher odds of being in an injury/fatal crash. Unexpectedly, girls had higher odds of having a crash or injury/fatal crash than boys.

POP cohort accounted for a significant increase in prediction for both violations and alcohol-related violations during the first year of driving following the POP (Table 2). Relative to other predictors, teens in the certification log cohort had the highest odds of a violation (1.79). Boys, teens of non-White race/ethnicity, teens living in urban areas, and teens in households with

lower median income had higher odds of receiving a violation. Teens in the certification log cohort had more than double the odds of an alcohol-related violation (2.45) and certification log cohort was the second strongest predictor. Boys and teens from households with lower median income had higher odds of having an alcohol-related violation.

3.3. Crashes and Violations in the POP Second Year

In year two of driving following the POP, 11,775 teens (8.9%) had a crash and 2,167 teens (1.6%) had an injury or fatal crash. The driver education cohort had significantly fewer crashes (5,940; 8.4%) than the certification log cohort (5,835; 9.5%), χ^2 (1) = 44.31, $p < .0001$ and significantly fewer injury or fatal crashes (1,064; 1.5%) than the certification log cohort (1,103; 1.8%), χ^2 (1) = 16.12, $p < .0001$. For violations, 22,324 teens (16.9%) had a violation and 522 (0.4%) had a DUI violation. The driver education cohort had significantly fewer violations (9,453; 13.4%) than the certification log cohort (12,871; 20.9%), χ^2 (1) = 1,311.32, $p < .0001$ and significantly fewer alcohol related violations (158; 0.2%) than the certification log cohort (364; 0.6%), χ^2 (1) = 112.35, $p < .0001$.

POP cohort accounted for significant increase in prediction for crashes and injury/fatal crashes during the second year of driving following the POP (Table 3). Relative to other predictors, teens in the certification log cohort had the second highest odds of a crash (1.13) or injury/fatal crash (1.18). Teens of living in urban areas and in households with lower median income had higher odds of being in a crash or an injury/fatal crash and teens of non- White ethnicity had higher odds of being in a crash. Unlike year 1, boys had higher odds of having a crash but there were no differences in injury/fatal crashes.

POP cohort accounted for a significant increase in prediction for violations and alcohol-related violations during the second year of driving following the POP (Table 4). Teens in the certification log cohort had the highest odds of a violation (1.59). As in year one, boys, teens of

non-White race/ethnicity, teens living in urban areas, and teens in households with lower median income had higher odds of receiving a violation. Teens in the certification log cohort had more than double the odds of an alcohol-related violation (2.39) and certification log cohort was the second strongest predictor. Boys, teens of non-White ethnicity, teens living in urban areas, and teens in households with lower median income had higher odds of an alcohol-related violation.

4. DISCUSSION

In relation to our primary research question, the cohort of teens who obtained their POP through driver education had significantly lower prevalence of a crash, injury/fatal crash, traffic violation, or DUI in both the first and second year of driving following the POP. When controlling for gender, ethnicity (White non-Hispanic vs other racial/ethnic groups), urban vs rural residence, and ACS median household income, teens in the certification log cohort had higher odds of a crash, injury/fatal crash, traffic violation, and DUI in both the first and second year of driving. The two year period of the POP covers ages 16-17. These are known high risk ages for teen crashes as crashes and injury or fatal crashes are highest in these years (Shope & Bingham, 2008; Foss et al., 2011). The higher crash risk likely is due to both the inexperience of teen drivers and the increased amount of unsupervised solo driving allowed in the intermediate state of the GDL. Because the 16-17 age range of the POP in Nebraska corresponds to this high risk period, the findings suggest that driver education potentially makes an important contribution to reducing crashes and violations during this critical period.

Foss et al. (2011) in examining North Carolina's GDL, which is similar to the Nebraska certification log method, identified several teen driver behaviors that were associated with crashes including inattention, failing to yield, exceeding safe speed for conditions, crossing the center line/going the wrong way, overcorrecting exceeding the speed limit and improper turning. They suggested that teen drivers lacked knowledge of how to handle the full range of driving

situations and that parental training during the supervised training period (log) may vary in comprehensiveness and quality. All of these driver behaviors are covered in the Nebraska Driver Education curriculum and driving practice within the course. Formal driver education may provide a more thorough and consistent training and instruction than informal parent or adult training thereby accelerating teens learning and better preparing them for unsupervised driving.

4.1. Strengths and Limitations

This study overcomes many of the limitations present in prior research and evaluations of driver education (see Beanland et al., 2013; Lonero & Mayhew, 2010, Peck 2011; Thomas, 2012). The study was a census of all Nebraska teen drivers receiving their provisional operators permit during the study period. The large study population eliminated problems of reduced power due to inadequate sample sizes identified by Peck (2011). The use of a census population also eliminated problems in sampling and sample attrition that have affected many prior studies, especially attempts at randomized trials (Lonero & Mayhew, 2010; Peck, 2011). We were able to control for important demographic characteristics that may have confounded findings in previous studies. Most significantly, we were able to draw on the presence of both driver education and comparable non-driver education cohorts in Nebraska. Teens can choose either driver education or a certification log, but all other aspects of the Nebraska GDL are the same for both. There is no time or age advantage for the driver education group, which eliminated a significant confound in other studies.

Despite these strengths, there are still limitations. The study is confined to a single small, predominantly rural state that may not be representative of the majority of states. The study is not a true randomized controlled experiment, as teen self-select whether they will take driver education or do the certification log. There are clear demographic differences in this choice, with certification log the choice of rural, male, non-White, and poorer teens. We were able to

apply statistical controls to these demographic differences, but statistical procedures cannot fully compensate for random assignment. We lacked control over the quality of driver education courses. Although all must meet state standards for approval, we cannot determine how well each individual course was delivered and how much specific curriculum and driving practice differed. Finally, we have no way of knowing how much supervision was actually done during the supervised driving recorded in the certification log, the quality of that supervision, or what additional training and education teens using the certification log may have received.

5. CONCLUSIONS

The overall conclusion that can be drawn from this study is that relative to a supervised driving certification log approach, teens taking driver education appear to have fewer crashes and injury or fatal crashes as well as fewer traffic violations and alcohol-related traffic violations. These differences were independent of gender, ethnic/racial, residence, and socio-economic factors. This is the first study to provide a population level direct comparison between driver education and an alternative licensing method where all other aspects of the GDL licensing process were the same for both groups. This strengthens confidence in the conclusion that driver education has a positive impact on reducing crashes and violations for teen drivers in their first two years of driving.

The findings appear counter to the prevalent argument that driver education is ineffective. In Nebraska, at least, driver education appears to be meaningfully effective in reducing traffic crashes and especially injury or fatal crashes among teens. The study examined only the first two years of driving, so we cannot determine how long any effects of driver education last. But, because teen crash and fatality rates are highest at ages 16 and 17, corresponding to their first two years of driving after receiving the POP in Nebraska, these reductions are especially meaningful. Driver education makes a difference at a time when risk is highest. Although not as

serious as crashes, violations reflect risky driving that can be a contributing factor to crashes (Blows et al., 2005; Shope & Bingham. 2008). The knowledge that teens learned in driver education about traffic laws and regulations and about safe versus risky driving appears to have led to reductions in actual risky and illegal behaviors as evidenced by lower incidents of traffic violations and DUI by teens completing driver education in this study.

Driver education appears to be an important tool for reducing crashes and risky driving as reflected in traffic violations within the context of graduated driver licensing. The findings suggest that the role of driver education in the GDL environment needs to be further examined by additional new studies.

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Table 1
Logistic Regression Predicting Crashes in the First Year of Driving Following POP

Predictor	$\Delta\chi^2$	*B*	*SE*	*OR*[1]	95% CI[2]
Crash					
Step 1	338.356***				
Race/ethnicity (1 = Other, 0 = White)		-.023	.026	.977	[.929, 1.028]
Urbanicity (1 = Urban, 0 = Rural)		.326***	.018	1.386	[1.337, 1.436]
Household income		-.058***	.009	.943	[.927, .960]
Gender (1 = Boy, 0 = Girl)		-.037*	.016	.964	[.934, .994]
Constant		-2.139***	.015	.118	
Step 2	139.970***				
Race/ethnicity (1 = Other, 0 = White)		-.070	.026	.933	[.886, .981]
Urbanicity (1 = Urban, 0 = Rural)		.334***	.018	1.396	[1.347, 1.446]
Household income		-.044***	.009	.957	[.940, .974]
Gender (1 = Boy, 0 = Girl)		-.042**	.016	.959	[.930, .989]
POP Cohort (1 = Log, 0 = DE)		.193***	.016	1.213	[1.175, 1.253]
Constant		-2.229***	.017	.108	
Injury/Fatal Crash					
Step 1	41.732***				
Race/ethnicity (1 = Other, 0 = White)		-.124**	.057	.883	[.789, .988]
Urbanicity (1 = Urban, 0 = Rural)		.113***	.039	1.120	[1.038, 1.209]
Household income		-.069***	.020	.933	[.897, .971]
Gender (1 = Boy, 0 = Girl)		-.171***	.034	.843	[.789, .901]
Constant		-3.685***	.030	.025	
Step 2	40.095**				
Race/ethnicity (1 = Other, 0 = White)		-.178***	.058	.837	[.747, .938]
Urbanicity (1 = Urban, 0 = Rural)		.121***	.038	1.129	[1.046, 1.218]
Household income		-.053***	.020	.948	[.911, .987]
Gender (1 = Boy, 0 = Girl)		-.177***	.034	.838	[.784, .896]
POP Cohort (1 = Log, 0 = DE[3])		.220***	.035	1.246	[1.164, 1.334]
Constant		-3.788***	.035	.023	

[1]OR=odds ratio; [2]CI=confidence interval; [3]DE=driver education.
*p<.05. **p<.01. ***p<.001.

Table 2
Logistic Regression Predicting Violations in the First Year of Driving Following POP

Predictor	$\Delta\chi^2$	*B*	*SE*	*OR*[1]	95% CI[2]
Violation					
Step 1	2320.46***				
Gender (1 = Boy, 0 = Girl)		.514***	.015	1.673	[1.623, 1.723]
Race/ethnicity (1 = Other, 0 = White)		.407***	.022	1.502	[1.440, 1.567]
Urbanicity (1 = Urban, 0 = Rural)		.242***	.017	1.274	[1.233, 1.316]
Household income		-.209***	.009	.812	[.797, .827]
Constant		-2.271***	.015	.103	
Step 2	1449.36***				
Gender (1 = Boy, 0 = Girl)		.503***	.015	1.654	[1.606, 1.705]
Race/ethnicity (1 = Other, 0 = White)		.269***	.022	1.309	[1.254, 1.367]
Urbanicity (1 = Urban, 0 = Rural)		.265***	.017	1.303	[1.261, 1.347]
Household income		-.165***	.009	.848	[.833, .864]
POP Method (1 = Log, 0 = DE[3])		.587***	.016	1.789	[1.745, 1.855]
Constant		-2.565***	.017	.077	
DUI Violation					
Step 1	59.27***				
Gender (1 = Boy, 0 = Girl)		1.035***	.183	2.816	[1.969, 4.029]
Race/ethnicity (1 = Other, 0 = White)		.437*	.213	1.549	[1.021, 2.349]
Urbanicity (1 = Urban, 0 = Rural)		.218	.172	1.243	[.887, 1.743]
Household income		-.381***	.109	.683	[.551, .846]
Constant		-7.735***	.183	.000	
Step 2	27.17***				
Gender (1 = Boy, 0 = Girl)		1.012***	.183	2.752	[1.923, 3.937]
Race/ethnicity (1 = Other, 0 = White)		.238	.215	1.269	[.832, 1.933]
Urbanicity (1 = Urban, 0 = Rural)		.244	.172	1.276	[.911, 1.788]
Household income		-.307**	.109	.735	[.594, .910]
POP Method (1 = Log, 0 = DE[3])		.895***	.179	2.448	[1.722, 3.480]
Constant		-8.225***	.217	.000	

[1]OR=odds ratio; [2]CI=confidence interval; [3]DE=driver education.
*p<.05. **p<.01. ***p<.001.

Table 3
Logistic Regression Predicting Crashes in the Second Year of Driving Following POP

Predictor	$\Delta\chi^2$	*B*	*SE*	*OR*[1]	95% CI[2]
Crash					
Step 1	194.341***				
Race/ethnicity (1 = Other, 0 = White)		.091**	.031	1.096	[1.032, 1.163]
Urbanicity (1 = Urban, 0 = Rural)		.276***	.022	1.317	[1.262, 1.375]
Household income		-.068***	.011	.934	[.914, .955]
Gender (1 = Boy, 0 = Girl)		.057**	.019	1.059	[1.020, 1.100]
Constant		-2.500***	.018	.082	
Step 2	37.271***				
Race/ethnicity (1 = Other, 0 = White)		.061*	.031	1.063	[1.001, 1.130]
Urbanicity (1 = Urban, 0 = Rural)		.279***	.022	1.322	[1.266, 1.380]
Household income		-.059***	.011	.942	[.922, .963]
Gender (1 = Boy, 0 = Girl)		.054**	.019	1.056	[1.016, 1.097]
POP Cohort (1 = Log, 0 = DE[3])		.122***	.020	1.129	[1.086, 1.174]
Constant		-2.554***	.020	.078	
Injury/Fatal Crash					
Step 1	18.660**				
Race/ethnicity (1 = Other, 0 = White)		.010	.070	1.010	[.880, 1.159]
Urbanicity (1 = Urban, 0 = Rural)		.166**	.049	1.181	[1.072, 1.300]
Household income		-.085**	.026	.918	[1.000, 1.000]
Gender (1 = Boy, 0 = Girl)		.067	.043	1.069	[.873, .966]
Constant		-4.211***	.040	.015	
Step 2	13.472***				
Race/ethnicity (1 = Other, 0 = White)		-.031	.071	.970	[.844, 1.115]
Urbanicity (1 = Urban, 0 = Rural)		.170**	.111	1.186	[1.077, 1.306]
Mean household income		-.073**	.026	.929	[.883, .978]
Gender (1 = Boy, 0 = Girl)		.062	.043	1.064	[.978, 1.158]
POP Cohort (1 = Log, 0 = DE[3])		.163***	.045	1.178	[1.079, 1.285]
Constant		-4.286***	.045	.014	

[1]OR=odds ratio; [2]CI=confidence interval; [3]DE=driver education.
*p<.05. **p<.01. ***p<.001.

Table 4
Logistic Regression Predicting Violations in the Second Year of Driving Following POP

Predictor	$\Delta\chi^2$	*B*	*SE*	*OR*[1]	95% CI[2]
Violation					
Step 1	2277.85***				
Gender (1 = Boy, 0 = Girl)		.503***	.015	1.653	[1.605, 1.703]
Race/ethnicity (1 = Other, 0 = White)		.400***	.022	1.491	[1.428, 1.557]
Urbanicity (1 = Urban, 0 = Rural)		.319***	.017	1.376	[1.331, 1.421]
Household income		-.190***	.009	.827	[.812, .841]
Constant		-2.083***	.014	.125	
Step 2	923.98***				
Gender (1 = Boy, 0 = Girl)		.493***	.015	1.638	[1.590, 1.687]
Race/ethnicity (1 = Other, 0 = White)		.288***	.022	1.334	[1.277, 1.394]
Urbanicity (1 = Urban, 0 = Rural)		.333***	.017	1.396	[1.351, 1.442]
Household income		-.156***	.009	.856	[.841, .871]
POP Cohort (1 = Log, 0 = DE[3])		.465***	.015	1.592	[1.545, 1.641]
Constant		-2.307***	.017	.100	
DUI Violation					
Step 1	188.38***				
Gender (1 = Boy, 0 = Girl)		1.018***	.101	2.769	[2.272, 3.374]
Race/ethnicity (1 = Other, 0 = White)		.626***	.113	1.870	[1.498, 2.334]
Urbanicity (1 = Urban, 0 = Rural)		.424***	.097	1.528	[1.264, 1.847]
Household income		-.208***	.053	.812	[.732, .901]
Constant		-6.500***	.103	.002	
Step 2	84.11***				
Gender (1 = Boy, 0 = Girl)		.996***	.101	2.707	[2.221, 3.299]
Race/ethnicity (1 = Other, 0 = White)		.433***	.115	1.541	[1.231, 1.930]
Urbanicity (1 = Urban, 0 = Rural)		.445***	.096	1.561	[1.292, 1.886]
Household income		-.140**	.053	.869	[.784, .964]
POP Cohort (1 = Log, 0 = DE[3])		.869***	.098	2.386	[1.967, 2.893]
Constant		-6.970***	.121	.001	

[1]OR=odds ratio; [2]CI=confidence interval; [3]DE=driver education.
*p<.05. **p<.01. ***p<.001.